FEM Simulation-Based Generative Adversarial Networks to Detect Bearing Faults

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Abstract

Complete fault sample is essential to activate artificial intelligent (AI) models. A novel fault detection scheme is proposed to build a bridge between AI and real-world running mechanical systems. First, the finite element method simulation is used to simulate samples with different faults to overcome the shortcoming of missing fault samples. Second, to enlarge datasets, new samples similar to the simulation and measurement fault samples are generated by generative adversarial networks and further combined with the original simulation and measurement samples to obtain synthetic samples. Finally, the synthetic and unknown fault samples are severed as the training and test samples, respectively, to the classifiers of AI models, and the unknown fault types will be finally determined. A public datasets of bearings have been used to verify the effectiveness of the proposed scheme. It is expected that the proposed scheme can be extended to complex mechanical systems.